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Interpretations of suture zones in Norway and adjacent areas – results from new aeromagnetic and gravity compilations

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The Geological Survey of Norway (NGU) is releasing new aeromagnetic and gravity maps of Norway and adjacent sea areas. The aeromagnetic compilation consists of 22 onshore surveys and more than 40 offshore surveys. The vintage offshore surveys have been reprocessed with an innovative moving mean levelling technique. The gravity map is based on a total of 68.000 gravity stations on the mainland acquired by NGU, SK and Norwegian and foreign academic institutions in addition to more than 500.000 km of marine gravity profiles acquired by NPD, SK, TGS and Norwegian and foreign petroleum companies. We have produced an Airy isostatic residual map, enhancing crustal anomalies better than traditional free air and Bouguer anomaly maps. We have recognized that petrophysical measurements on core samples, hand specimens and in situ on bedrock exposures are essential for the interpretation of these anomalies. Petrophysical data (density, magnetic susceptibility and remanence) of 40.000 rock samples from the Norwegian mainland and susceptibility measurements of c. 7000 metres of cores from offshore drill holes have been acquired in order to constrain the interpretation of aeromagnetic and gravity data.

Some of the most prominent gravity and magnetic anomalies in the region are attributed to lower crustal rocks occurring at a shallow level in the crust e.g. along the Lapland Granulite Belt in northern Fennoscandia, along the Bamble-Kongsberg Complex in southern Norway and in the Lofoten area. The emplacement of high grade and high-density lower crustal on top of upper crustal rocks produces a distinct gravity anomaly with a steep gradient along the suture zone and a much gentler gradient on the hinterland side. The asymmetry of the gravity anomalies along the Lapland Granulite Belt and Kongsberg-Bamble Complex, combined with the steep gradient, points to the over-thrusted high-grade and high-density granulites as the main source of the observed positive gravity anomaly. The Bouguer gravity anomaly associated with the Kongsberg-Bamble complex can be traced southwards through the Kattegat to the Scania region in southern Sweden. This asymmetric anomaly has previously been related to deep-seated mafic intrusions of Permian age. Our new suture zone interpretation is in accordance with reflection seismic data from northern Skagerrak and Bornholm areas. The regional suture zones were later reactivated as continental rifts. This concept of gravity field modeling can also be applied to the mid-Norwegian continental shelf and partially explain the observed high-density rocks occurring below the Møre and Vøring basins and in the Lofoten area.